Accepted for publication 27 April 2005. Published 10 May 2005.

First Report of *Raspberry bushy dwarf virus* in Ohio

M. A. Ellis, Department of Plant Pathology, Ohio Agricultural Research and Development Center, The Ohio State University, Wooster 44691; **J. Kraus** and **R. R. Martin,** United States Department of Agriculture, Agricultural Research Service, Corvallis, OR 97330; and **S. R. Wright,** The Ohio State University South Centers, Piketon 45661

Corresponding author: Mike Ellis. ellis.7@osu.edu

Ellis, M. A., Kraus, J., Martin, R. R., and Wright, S. R. 2005. First report of *Raspberry bushy dwarf virus* in Ohio. Online. Plant Health Progress doi:10.1094/PHP-2005-0510-01-HN.

Over the past 10 years, several commercial producers of black raspberry (*Rubus occidentalis*) in Ohio have experienced a decline in plant vigor and survival in their plantings. Symptoms include small, dry, and mishapened berries, foliar chlorosis, and premature dying of fruiting canes before or during harvest. This decline generally has been attributed to winter injury, and yield losses of up to 100% have been observed in some plantings. The symptoms are similar to those observed in black raspberry affected by black raspberry decline in the Willamette Valley of Oregon (4). In 2004, a survey of several black and red raspberry plantings in Ohio was conducted to determine if viruses were present. Eighteen black raspberry and five red raspberry commercial plantings were sampled. Plantings ranged in size from one to five acres. Fields were sampled by walking a zig-zag pattern and randomly collecting one leaflet from a plant approximately every five meters. One sample consisted of three leaflets, and five samples were collected from each field (a total of 15 plants sampled per field). Most randomly selected leaves were asymptomatic, and most plantings sampled appeared normal or generally healthy. The purpose of this survey was to determine if viruses were present, and no attempts were made to associate virus detection with symptoms in the field. Samples were shipped to the USDA-ARS Horticultural Crops Research Laboratory in Corvallis for virus testing.

Double-antibody sandwich ELISA was used for detection of *Tomato ringspot* (ToRSV) and *Tobacco ringspot virus* (TRSV), whereas triple-antibody sandwich ELISA was used for the detection of *Raspberry bushy dwarf* (RBDV) and *Tobacco streak virus* (TSV). ELISA tests were carried out as described previously (6). Reactions were considered positive if the A_{405} values were greater than 5 times the values obtained for healthy controls, and greater than 0.1. Absorbance values of healthy samples ranged from 0.00 to 0.05. Seven of the samples that tested positive for RBDV by ELISA were also tested by RT-PCR using primers flanking the movement protein (MP) and coat protein (CP) encoding region as described previously (1). The complete sequences of the CP and MP open reading frames were determined from four clones of the 2.2 kb DNA fragment amplified with the RBDV primer pair FM-2 (5' TTTGCTCTTTGGTGGTC) and RC-2 (5' GCCGTTTATCTCACAAATTGTG).

Of the 115 samples taken in the survey, RBDV, ToRSV, and TRSV were detected in 21 (~18%), 5 (~4%), and 2 (~2%), respectively. In three black raspberry plantings, one of the cultivar Bristol in northern Ohio, one of Bristol in southern Ohio and one of Jewel in central Ohio, RBDV was detected in all samples. This is the first report of RBDV in Ohio. Based on the sequence of the CP and MP of the isolate sequenced, it appears nearly identical to isolates from black raspberry in Oregon, differing by only one base in each open reading frame (1). ToRSV and TRSV have been detected previously in Ohio (Mike Ellis, *unpublished*).

The effects of RBDV on raspberry plant health and yield in Ohio are unknown. In an impact study of RBDV infection in 'Marion' blackberry in Oregon, it was shown that fruit quality was greatly affected with drupelet number, fruit weight, and yield reduced by 36 to 39%, 23 to 40%, and 40 to 50%, respectively (6). In 'Meeker,' 'Canby,' and 'Lloyd George' red raspberry infected with RBDV, cane height, cane diameter, and yield were all significantly reduced compared to virus-free plants (2). RBDV is pollen transmitted, so once established in an area control may be very difficult (5).

At present, the only effective means of control for RBDV is the use of immune cultivars. The red raspberry cultivars Williamette, Haida, Heritiage, and Latham are reported to be graft-immune to the disease (3). Heritage and Latham are commonly grown in Ohio. All black raspberry and blackberry cultivars tested have been graft-susceptible to RBDV (3). Further research is needed in order to determine the extent to which RBDV is present in Ohio, and its effects on raspberry plant health as well as production.

Literature Cited

1. Chamberlain, C. J., Kraus, J., Kohnen, P. D., Finn, C. E., and Martin, R. R. 2003. First report of *Raspberry bushy dwarf virus* in *Rubus multibracteatus* from China. Plant Dis. 87:603.
2. Daubeny, H. A., Freeman, J. A., and Stace-Smith, R. 1982. Effects of raspberry bushy dwarf virus on yield and cane growth in susceptible red raspberry cultivars. HortSci. 17:645-647.
3. Ellis, M. A., Converse, R. H., Williams, R. N., and Williamson, B. 1991. Compendium of raspberry and blackberry diseases and insects. American Phytopathological Society, St. Paul, MN.
4. Halgren, A. B., Tzanetakis, I. E., and Martin, R. R. 2003. Characterization of an aphid-transmitted virus associated with black raspberry decline in Oregon. Phytopathology 93:S32.
5. Martin, R. R. 1999. Raspberry viruses in Oregon,Washington and British Columbia. Acta Hortic. 505:259-262.
6. Strik, B. C., and Martin, R. R. 2003. Impact of *Raspberry bushy dwarf virus* on 'Marion' blackberry. Plant Dis. 87:294-296.